a second connector for connecting a second exterior line to said one of said first and second headers having said second feed opening, said second exterior line for carrying said fluid, said second connector secured in said second feed opening in line with said flat tubes;

said first and second feed openings being substantially rectangular with a depth substantially equal to the depth of said core.--

REMARKS

Claims 1-8, 10 and 12 have been canceled herein. New claims 13-18 have been added. Accordingly, claims 9, 11 and 13-18 are now pending.

New claims 13-15 variously recite the extremely compact heat exchanger according to the present invention. Specifically, new claim 13 recites, *inter alia*, a structure in which one of the headers includes a portion extending beyond one of the end tubes with one of the inlet and outlet in that extending portion, a first connector proximate and in line with one of the first and second end tubes, and a second connector proximate and in line with the other of the end tubes. (As indicated at page 11, lines 1-2 of the specification, "in line with" in the present application means that it extends in the same direction from the header.) This unique structure allows the heat exchanger to minimize the space required for its installation, with the inlet and outlet being

proximate the tube rows rather than extending out in different directions. Of course, in many installations, such as automobiles, minimizing size to fit into a restricted space is a crucial element of the heat exchanger design.

It is respectfully asserted that the references relied upon in the Office Action as §102 or §103 references against the now canceled claims do not teach this structure:

1. Nakaguro U.S. Patent No. 5,095,972 does not have connectors oriented such as claimed. Rather, Nakaguro includes a block in the face of the heat exchanger for the inlet and outlet. While this structure may help to make the heat exchanger more compact, it would have obvious detrimental effects on the heat exchange capacity by blocking air flow in the middle of the heat exchanger face. It is also noteworthy that at least two embodiments in Nakaguro (Fig. 1 and 11) have outwardly extending outlets which would require additional space.
2. JA 3-79994 similarly locates its inlet/outlet structure within the face of the heat exchanger, rather than adjacent the end tubes as disclosed and claimed herein. Thus, it too will have obvious detrimental effects on the heat exchange capacity by blocking air flow in the middle of the heat exchanger face. Beyond its location in the face, the configuration also requires that at least 2 of the tubes be bent around it, which not only changes the flow from a straight path, but also results in portions of

those tubes abutting adjacent tubes without any air-side fins therebetween, thereby further adversely affecting heat exchange efficiency.

3. JA 6-273088 similarly locates its inlet/outlet within the face of the heat exchanger, with detrimental effect on efficiency such as already discussed with the other §102 or §103 references. Applicant acknowledges the showing in Fig. 7 of JA6-273088 of an inlet or outlet nearer the end of the tube rows; however, it should be noted that the structure nevertheless requires a structure extending significantly from the face of the heat exchanger (see reference numerals 7 and 15 in Fig. 3). Further, the connector in this reference is clearly annular (not rectangular as recited in claim 15) and such structure unnecessarily restricts the inlet/outlet opening for any given opening thickness, which is again contrary to the desire, accomplished with the present invention, to minimize required space for the heat exchanger.

4. JP10-197190 appears to have one inlet/outlet 11 in an extension of a header tube and in line with the tubes. However, as shown in Fig. 4, the inlet/outlet 11 is not proximate the end tube, but is significantly spaced therefrom, directly contrary to the desire for compact structure as already discussed above. Moreover, only one of the inlet/outlet is so arranged, with the other inlet/outlet 12 extending outwardly from the header tube (see bottom right of Fig. 1). Still further, with respect to claim 15, the

tubes are clearly annular, which again would not allow for the same capacity as the present invention without necessarily also increasing the heat exchanger size as already discussed.

5. Sasaki et al. U.S. Patent No. 5,458,190 is similarly inadequate to JP '190 in its teachings, in that it too shows (1) an inlet 7 which, though in line with the tubes, is significantly spaced from the end tube, (2) an outlet 8 which extends outwardly from the header tube, and (3) has annular tubes for the inlet/outlet. All of these features are contrary to the claimed invention, and are contrary to the creation of compact heat exchangers as previously discussed.

6. DE 4212070 is also inadequate in its teachings in many of the above discussed respects. For example, as clearly illustrated in Fig. 1, while the inlet tube extends from one header tube in line with the tubes, it actually extends through the other header tube so that both the inlet and the outlet are not in line with the tubes but extend in the opposite direction (down at the bottom left of Fig. 1).

The other references additionally relied upon with respect to claim 8 (which is now generally the subject of dependent claim 15) do not, respectfully, overcome the above inadequacies. That is, while Le Gauyer U.S. Patent No. 5,275,236 and DE 19527050 disclose rectangular pipes, neither disclose such pipes proximate to an in line with the end tubes of the heat

exchanger. While it may be obvious to connect rectangular pipes to rectangular pipes, the present invention uses the rectangular connectors for their compactness in a particularly unique configuration (proximate to and in line with the end tubes) which is not taught in the references. Therefore, the addition of rectangular tubes from either of these references for the inlet and outlet of any of the primary references would still not teach the claimed invention.

New claims 16-17[1] more specifically relate to the embodiment shown in Figs. 9-12 of the present application, wherein the tube passages are formed by joined flat members, with the flat members being enclosed on their ends by headers. This header configuration is uniquely able to secure an in line connector proximate the end flat members forming the tube passages (with in line proximate connectors providing the space saving advantages already discussed). No such structure is believed to be in any way shown in the cited references. Accordingly, claims 16-17 are also believed to be allowable.

Claims 9 and its dependent claim 11 are also believed to be allowable for at least the reasons discussed above with respect to claims 13 et al. Specifically, claim 9 recites, *inter alia*, a compact cooling system with a radial fan, a plurality of heat exchangers according to claim 13 disposed around the fan, and a system inlet and a system outlet, one of the system inlet and outlet

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[1]New dependent claim 14, like canceled claim 6, similarly relate to this embodiment in which the tubes are defined by connected flat members.

being connected via first exterior lines to the first connectors of at least two of the heat exchangers. While Benz et al. U.S. Patent No. 3,921,603 and DE 19724728 disclose structures with heat exchangers about a radial fan, none show such structures with the compact heat exchangers disclosed by applicant and recited in base claim 13. As previously discussed, neither JA 6-273088 nor any of the other references teach such heat exchangers, which heat exchangers have particular advantage in such a configuration where multiple heat exchangers are used in a limited space. Accordingly, claims 9 and 11 should also be allowed.

New independent claim 18 recites a heat exchanger which embodies many of the unique and advantageous structural elements already discussed. Specifically, claim 18 recites, *inter alia*, a heat exchanger with two headers each having a laterally extending wall with aligned tube openings. A first feed opening is proximate an end one of the tube openings in the first header wall. A second feed opening is proximate an end one of the tube openings in the wall of one of the headers. A plurality of flat tubes are secured at opposite ends to the aligned header tube openings and define a heat exchanger core having a depth. A first connector is secured in the first header feed opening in line with the flat tubes, and a second connector is secured in the second feed opening in line with the flat tubes. The first and second feed openings are

substantially rectangular with a depth substantially equal to the depth of the core.

Thus, claim 18 recites the compact heat exchanger according to the present invention, with both connectors proximate and in line with the tubes. Further, the connectors are rectangular and have a depth substantially equal to the core depth. Such a configuration ensures that the connector opening size may be maximized for the core while also minimizing its outer dimension (*i.e.*, the amount it extends on the end of the heat exchanger beyond the tube rows). No such structure is shown or taught in the prior art. Accordingly, claims 18 should also be allowable.

In considering the above, the Examiner is requested to take care not to improperly use hindsight in combining the many different references cited herein. Based on prior dealings with the Examiner, the undersigned is well aware of his high level of knowledge in the field, and it is simply requested that the Examiner take care not to fall into the trap of viewing "simple" structures as an obvious combination of old teachings of different structural elements. Such care is particularly important in cases, such as this one, where the ingenuity of the invention is in obtaining significant desired advantages in a structurally simple device. As the Examiner is well aware, compactness of heat exchangers is a goal sought by manufactures of such devices at great expense for a long period of time. It is therefore believed to be appropriate to recognize that the

structure claimed herein has not been suggested by others, despite the long felt need, and the references should be considered in that light before concluding that it would be simple or obvious to combine different elements of the references, none of which met the needs as does the claimed invention.

In view of the above, it should properly be recognized that all of claims 9, 11 and 13-18 are believed to be allowable. Early notification to that effect is respectfully requested.

Respectfully submitted,

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AMENDED CLAIMS

Claims 1-8, 10 and 12 are canceled.

Claims 9 and 11 are amended and claims 13-18 added as follows:

9. (Amended) A compact cooling system, comprising:

a radial fan having an axis, said radial fan directing air flow outwardly away from said fan axis;

a plurality of heat exchangers according to claim [1] 13 disposed around said radial fan, said first and second headers extending generally in the same direction as said fan axis with said plurality of flat tubes spaced from a system front to a system back across said air flow; and

a system inlet and a system outlet, one of said system inlet and system outlet being connected via said first exterior lines to the first connectors of at least two of said heat exchangers.

11. (Amended) The compact cooling system of claim [10] 9, wherein said heat exchangers are disposed around said fan with said first connectors adjacent one of said system front and system back and said second connectors adjacent the other of said system front and system back.

--13. (New) A heat exchanger, comprising:

a plurality of flat tubes extending between first and second headers, said plurality of tubes being substantially parallel between first and second end tubes of said plurality of flat tubes, said plurality of flat tubes adapted to carry a fluid between said first and second headers;

an inlet in said first header;

an outlet in one of said first and second headers;

one of said first and second headers including a portion extending beyond one of said first and second end tubes whereby one of said inlet and outlet is in said extending portion of said one of said first and second headers;

a first connector for connecting a first exterior line to said one of said inlet and outlet in said header extending portion, said first connector being proximate and in line with said one of said first and second end tubes; and

a second connector for connecting a second exterior line to the other of said inlet and outlet in another header extending portion, said second connector being proximate and in line with the other of said first and second end tubes.

14. (New) The heat exchanger of claim 13, wherein said tubes are defined by a plurality of flat members joined along longitudinal sides to define tube passages between joined flat members.

15. (New) The heat exchanger of claim 13, wherein said first connector has a rectangular cross section having a flat face proximate said one of said first and second end tubes.

16. (New) A heat exchanger, comprising:

a plurality of flat members joined along longitudinal sides to define tube passages between joined flat members, adjacent flat members defining different tube passages being connected at their ends;

first and second headers at opposite ends of said flat members enclosing said defined tube passages;

an inlet in said first header;

an outlet in one of said first and second headers;

one of said first and second headers including a portion extending beyond one end flat member whereby one of said inlet and outlet is in said extending portion of said one of said first and second headers;

a first connector for connecting a first exterior line to said one of said inlet and outlet in said header extending portion, said first connector being proximate and in line with said one end flat member.

17. (New) The heat exchanger of claim 16 further comprising a second connector for connecting a second exterior line to the other of said inlet and outlet in another header extending portion, said second connector being proximate and in line with the other of said end flat members.

18. (New) A heat exchanger, comprising:

a first header having a laterally extending wall with a plurality of tube openings and a first feed opening proximate an end one of said tube openings in said wall;

a second header having a laterally extending wall with a plurality of tube openings aligned with the tube openings of said first header;

a plurality of flat tubes secured at opposite ends to said aligned header tube openings for carrying a fluid between said first and second headers, said plurality of flat tubes defining a heat exchanger core having a depth;

a second feed opening proximate an end one of said tube openings in said wall of one of said first and second headers;

a first connector for connecting a first exterior line to said first header, said first exterior line for carrying said fluid, said first connector secured in said first header feed opening in line with said flat tubes; and

a second connector for connecting a second exterior line to said one of said first and second headers having said second feed opening, said second exterior line for carrying said fluid, said second connector secured in said second feed opening in line with said flat tubes;

said first and second feed openings being substantially rectangular with a depth substantially equal to the depth of said core.--